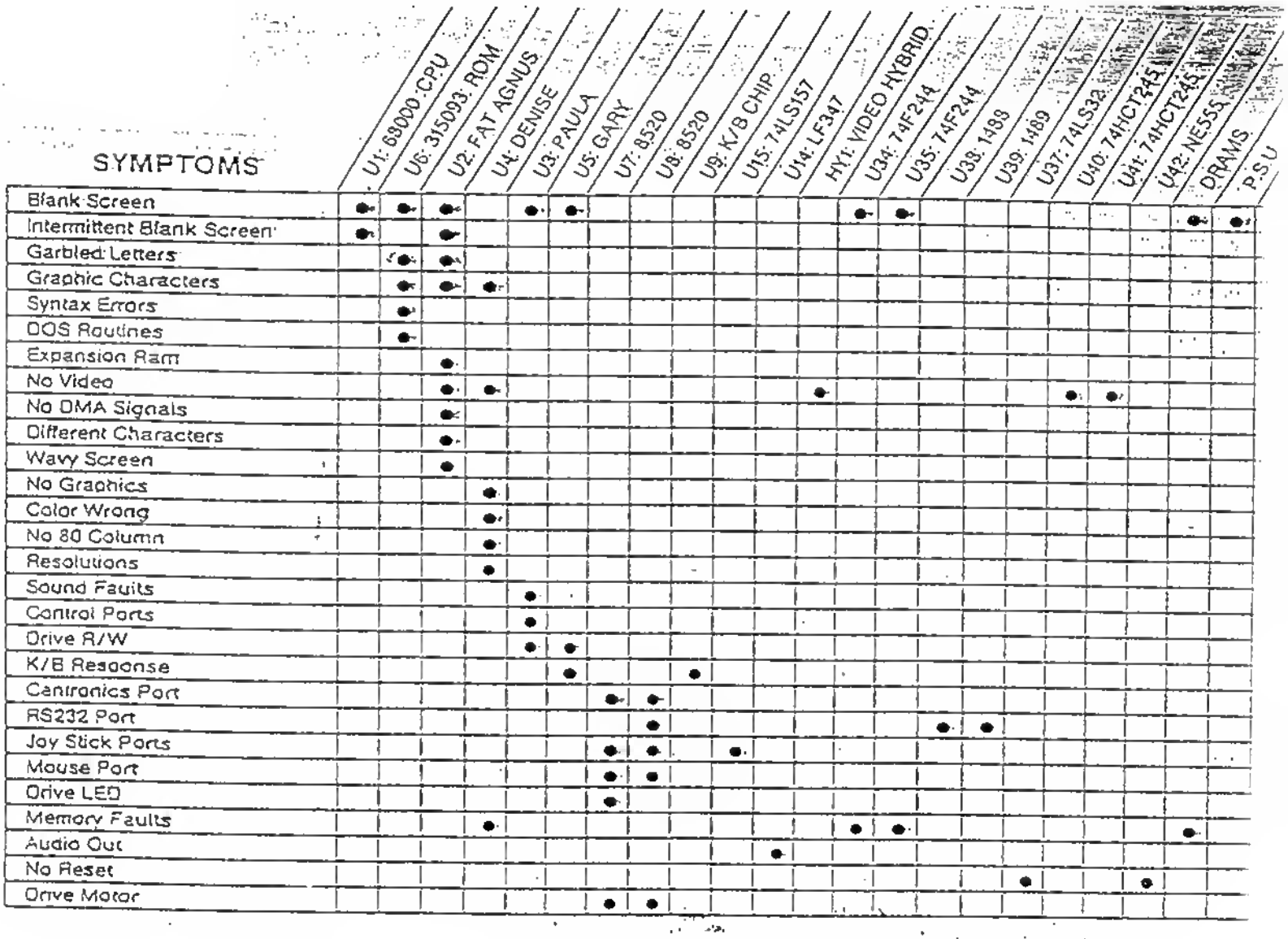
THE AMIGA DIAGNOSTICIAN

Part #MAN 18

AMIGA A500 FAULT FINDING DIAGNOSTIC CHART



HINTS AND TIPS

Always check the obvious before removing components. For example: Is the Power Supply Unit OK? Is the Disk Drive Unit functioning correctly? Are all leads securely attached? Is the Monitor OK?

Most faults causing the computer not to initialize will be found on one of the custom chips or the CPU or possibly more than one memory chip is down.

Disk drive faults will be located on the drive or one or both of the CIAs, usually.

certain areas of the computer. This will assist you further in the use of the guide. The third section contains all the data charts for each I.C. in the computer and the signals that should be present on each pin. Within this section are details of the Address and Data lines and Video and Sound adjustments. The final section lays out a fault-finding guide to the most common faults.

When faced with a faulty computer, the idea of diagnosing the problem can seem a daunting task. With information of what should be correct in the system, inexpensive and easy-to-use tools, and a guide to the steps to take makes the task seem less daunting. When common sense is used and a logical approach taken, then there is a high probability of finding the fault on the computer.

The tools used with this guide are a logic probe and an inexpensive multimeter. The logic probe used to compile the information in this guide is an Altai (model HYT-07). Any reasonable multimeter can be used for the voltage readings.

USE OF THE LOGIC PROBE

The type of probe used has two leads. The black (-) lead is connected to a convenient "ground" such as the modulator case. The red (+) lead is connected to a +5 volts d.c. supply. A handy place for this is the bottom of L2 (located below and right of the modulator). The metal probe on the main body of the logic probe is then placed on the item to be tested.

THE PULSE SWITCH ON THE PROBE IS PRESSED IN FOR ALL TESTS.

The results of the test are interpreted: where there is a "high" signal expected, a "high" signal should be seen on the probe. There could be activity, or not, on some signals so there could be variations in the results shown on the probe to that listed in the guide. (This is especially true if a different type of logic probe is used to that used to compile the guide.) The important point is that essentially the results expected are either "high" (5 volts) or "low" (0 volts) and anything opposite to this is incorrect. The pulse element of any signal may not be present if the computer is "dead" as there will not be any activity going on. Signals very different from those listed in the guide should be treated as a suspect.

USE OF THE VOLTMETER (MULTIMETER)

A multimeter, set to the 12 volt d.c. voltage range, can be used instead of the logic probe for most tests. Readings in the clock circuits will not be reliable however. The black (-) lead is connected to the "grounds." The red (+) lead is placed on the item under test. Readings should follow those printed in the guide although an allowance of around can/- 0.2 volts may be accepted, as the voltage readings in the guide are only to one decimal place. Again, results very different from those printed should be treated as suspect.

Only a voltmeter is suitable for checking the voltages in the Power Supply circuits. Most of the tests are done with the black (-) lead connected to a "ground." However, some

tests are done across components such as capacitors are the bridge rectifier. When doing these tests on the d.c. components, make sure that the leads are connected to the correct polarity: i.e. black (–) lead to (–) negative side of components and red (+) lead to (+) positive side of component. There is also 9 volts a.c. in these circuits, so when checking the 9 volts a.c., the miltimeter requires being switched to the 12 volts a.c. range. Polarity is not important when testing a.c. voltages.

When using both the logic probe and the multimeter, care needs to be taken that adjacent pins on the I.C.s are not accidentally shorted together with the test probe. If this does occur, the computer may "crash." The computer needs to be switched off and switched on again in order to clear this "crash."

[illegible] negative side [illegible]

[illegible]

GENERAL INFORMATION

68000 CPU

The 68000 is an advanced 16-bit microprocessor.
The CPU requires a single phase clock input at 8MHz.
The chip operates on a single +5 volts supply.

The Amiga A500 utilizes three custom chips and a control chip. These are:

U3: FAT AGNUS - Custom Animation Chip (or 8372A Fatter Agnus Chip)
U4: 8364 PAULA - Sound and Peripherals Chip

U5: 5719 GARY - Custom Control Chip

The Kickstart ROM (U6) contains the kernal and DOS routines

The two CIA chips 8520 (U7 & U8) provide the I/O interfacing

The external PSU provides outputs as follows:

Pin 1: +5 volts
Pin 2: Shield (GROUND)
Pin 3: +12 volts
Pin 4: GROUND
Pin 5: -12 volts

I.C. TABLE

U1	MC68000	CPU
U2	8370 (8372)	FAT AGNUS (NTSC)
U3	8364	PAULA
U4	8362	DENISE
U5	5719	GARY
U6	ROM	KICKSTART
U7	8520	CIA
U8	8520	CIA
U10, 12	74LS244	OCTAL TRI-STATE NON-INV. BUFFER/LINE DRIVER/RECEIVER
U11, 13	74LS373	OCTAL TRI-STATE D-TYPE LATCH
U14	LF347/TL084	
U15	74LS157	QUAD 2 TO 1 LINE DATA SELECTOR
U16-31	256K X 1 DRAM	DYNAMIC RANDOM ACCESS MEMORY
U32	74F74	DUAL D-TYPE BISTABLE (FAST)
U33	74F04	HEX INVERTER (FAST)
U34, 35	74F244	OCTAL TRI-STATE NON-INV. BUFFER/LINE DRIVER/RECEIVER (FAST)
U36	74LS38	QUAD 2-INPUT o.c.NAND BUFFER
U37	74LS32	QUAD 2-INPUT OR
U38	1488	LINE DRIVER
U39	1489	RECEIVER
U40, 41	74HX245	OCTAL TRI-STATE NON-INV. BUS TRANSCEIVER
U42	NE555	

MC68000 CPU

D4	1	64	D5
D3	2	63	D6
D2	3	62	D7
D1	4	61	D8
D0	5	60	D9
AS	6	59	D10
*UDS	7	58	D11
*LDS	8	57	D12
R/W	9	56	D13
*DTACK	10	55	D14
*BG	11	54	D15
*BGACK	12	53	0v
*BR	13	52	A23
+5v	14	51	A22
Ø	15	50	A21
0v	16	49	+5v
*HALT	17	48	A20
*RESET	18	47	A19
*VMA	19	46	A18
EN	20	45	A17
*VPA	21	44	A16
*BERR	22	43	A15
*IPL2	23	42	A14
*IPL1	24	41	A13
*IPL0	25	40	A12
FC2	26	39	A11
FC1	27	38	A10
FC0	28	37	A9
A1	29	36	A8
A2	30	35	A7
A3	31	34	A6
A4	32	33	A5

I.C.	I.C.TYPE	DESCRIPTION
U1	MC68000	CENTRAL PROCESSOR UNIT (MICROPROCESSOR)

PIN	L/PROBE			VOLT	LABEL	DETAILS	SIG	CONNECTIONS
No.	H	L	P	MET.			TYP	
1	*	*	*	1.9v	D4	DATA-BUS		SEE DATA-BUS CHART
2	*	*	*	2.7v	D3	"		"
3	*	*	*	2.1v	D2	"		"
4	*	*	*	1.7v	D1	"		"
5	*	*	*	1.5v	D0	"		"
6	*	*	*	1.6v	*AS	ADDR.STROBE		U2(24),EXP.P1(74)
								U5(13),RP1D1(8)
7	*	*	*	1.9v	*UDS	UP.D.STROBE		U2(53),EXP.P1(72)
								U5(11),RP1D1(6)
8	*	*	*	1.9v	*LDS	LD.D.STROBE		U2(52),EXP.P1(70)
								U5(10),RP1D1(5)
9	*		*	4.5v	R/W	READ/WRITE		U2(22),EXP.P1 (68)
								U5(12),RP101(7)
								U7(22),U8(22)
10	*	*	*	3.1v	DTACK	*DTACK		R101-U5(43),
								RP104(2),EXP.P1(66)
11	*			4.5v	*BG	(SEE NOTES)		EXP.P1(64)
12	*			5.2v	BGACK	(SEE NOTES)		RP104(4),U5(14)
								EXP.P1(62)
13	*			5.2v	*BR	(SEE NOTES)		RP104(5),EXP.P1(60)
14	*			5.2v	Vcc	+5 VOLTS		+ 5 VOLTS D.C.
15	*	*	*	1.6v	CLK	CLOCK 7MHz		R103(2),RP103-U4(38
								U4(35) U2(38)
16		*		0v	GND	GROUND		
17	*			5.2v	*HALT	(SEE NOTES)		U5(42),RP1D1(9)
								EXP.P1(55)
18	*			5.2v	*RES	(SEE NOTES)		U2(16),U5(41)
								RP104(4),U3(11)
								EXP.P1(53)
19	*		*	5.2v	*VMA	(SEE NOTES)		RP102(10),U37(2&5)
								EXP.P1(51)
20	*	*	*	2.0v	EN	(SEE NOTES)		U7(25),U8(25),
								EXP.P1(50)
21	*		*	5.2v	*VPA	(SEE NOTES)		R102-U5(2),R101(2)
								EXP.P1(48)
22	*			5.2v	*BERR	(SEE NOTES)		RP104(3)EXP.P1(46)
23	*			5.2v	*IPL2	(SEE NOTES)		RP102(9),U3(15)
								EXP.P1(44)
24	*		*	5.1v	*IPL1	(SEE NOTES)		RP102(8),U3(14)
								EXP.P1(42)
25	*		*	5.1v	*IPL0	(SEE NOTES)		RP102(7),U3(13)
								EXP.P1(40)
26		*	*	204m	FC2	(SEE NOTES)		RP102(6),EXP.P1(35)
27	*	*	*	3.2v	FC1	(SEE NOTES)		RP102(5),EXP.P1(33)
28	*	*	*	1.9v	FC0	(SEE NOTES)		RP102(4),EXP.P1(31)
29	*	*	*	2.3v	A1	ADD.LINE		SEE ADDRESS CHART
30	*	*	*	2.4v	A2	"		"
31	*	*	*	2.3v	A3	"		"
32	*	*	*	2.3v	A4	"		"

U1 MC68000 MICROPROCESSOR (CONTINUED)

PIN No.	L/PROBE H	L	P	VOLT MET.	LABEL	DETAILS	SIG TYP	CONNECTIONS
33	*	*	*	2.1v	A5	A00.LINE		SEE ADDRESS CHART
34	*	*	*	1.6v	A6	"		"
35	*	*	*	3.3v	A7	"		"
36	*	*	*	1.8v	A8	"		"
37	*	*	*	2.0v	A9	"		"
38	*	*	*	1.6v	A10	"		"
39	*	*	*	2.9v	A11	"		"
40	*	*	*	2.5v	A12	"		"
41	*	*	*	0.8v	A13	"		"
42		*	*	238m	A14	"		"
43	*	*	*	2.0v	A15	"		"
44		*	*	51mV	A16	"		"
45	*	*	*	2.0v	A17	"		"
46	*	*	*	2.7v	A18	"		"
47	*	*	*	2.6v	A19	"		"
48	*	*	*	2.6v	A20	"		"
49	*			5.2v	Vcc	+ 5 VOLTS		+ 5 VOLTS O.C.
50	*	*	*	2.6v	A21	A00.LINE		SEE ADDRESS CHART
51	*	*	*	2.6v	A22	"		"
52	*	*	*	2.6v	A23	"		"
53		*		0v	GND	GROUND		
54	*	*	*	0.6v	D15	DATA LINE		SEE DATA LINE CHART
55	*	*	*	1.4v	D14	"		"
56	*	*	*	1.4v	D13	"		"
57	*	*	*	0.7v	D12	"		"
58	*	*	*	1.4v	D11	"		"
59	*	*	*	1.5v	D10	"		"
60	*	*	*	1.7v	D9	"		"
61	*	*	*	1.1v	D8	"		"
62	*	*	*	1.4v	D7	"		"
63	*	*	*	1.8v	D6	"		"
64	*	*	*	2.2v	D5	"		"

NOTE

Pin numbers that have an asterisk with their label name are signals that are switched on and are active when the signal is in a " low " state.

Pin numbers without an asterisk to their label name are signals that are active in a " high " state.

I.C.	I.C.TYPE	DESCRIPTION
U2	8370(NTSC) (8372)	FAT AGNUS
U2	8371(PAL)	

PIN No.	L/PROBE H	L	P	VOLT MET.	LABEL	DETAILS	SIG TYP	CONNECTIONS
1	*	*	*	1.2v	DRD13			U13(14),CNX(18),
								U29(2),U3(44),U4(42)
								U12(7)
2	*	*	*	1.2v	DRD12			U12(9),U13(13),
								CNX(17),U28(2),U3(45
								U4(43)
3	*	*	*	1.5v	DRD11			U12(12),U13(8),
								CNX(16),U27(2),U3(46
								U4(44)
4		*		0v	DRD10			U12(14),U13(7),
								CNX(15),U26(2),U3(47
								U4(45)
5	*		*	4.8v	DRD9			U12(16),U13(4),
								CNX(14),U25(2),U3(48
								U4(46)
6	*		*	3.7v	DRD8			U12(18),U13(3),
								CNX(13),U24(2),U3(1)
								U4(47)
7	*		*	5.1v	DRD7			U10(3),U11(18),
								CNX(12),U23(2),U3(2)
								U4(48)
8	*			5.1v	DRD6			U10(5),U11(17),
								CNX(11),U22(2),U3(3)
								U4(1)
9	*	*	*	2.7v	DRD5			U10(7),U11(14),
								CNX(10),U21(2),U3(4)
								U4(2)
10	*	*	*	2.0v	DRD4			U10(9),U11(13),
								CNX(9),U20(2),U3(5)
								U4(3)
11		*	*	52mV	DRD3			U10(12),U11(8),
								CNX(8),U19(2),U3(6)
								U4(4)
12	*	*	*	2.0v	DRD2			U10(14),U11(7),
								CNX(7),U18(2),U3(7)
								U4(5)
13	*	*	*	240m	DRD1			U10(16),U11(4),
								CNX(6),U17(2),U3(9)
								U4(6)
14	*	*	*	0.9v	DRD0			U10(18),U11(3)
								CNX(5),U16(2),U3(10)
								U4(7)
15	*			Vcc		+5 volts		+5 VOLTS D.C.
16	*	*	*	2.9v	*RST	*RESET		U1(18),U5(41),U3(11)
								RP104(4),EXP.P1(53)
17	*	*	*	4.1v	*INT3			U3(17)
18		*	*	102m	DMAL			U3(12)

U2 8370/8372 FAT AGNUS (CONTINUED)

PIN No.	L/PROBE H	L/PROBE L	L/PROBE P	VOLT MET.	LABEL	DETAILS	SIG TYP	CONNECTIONS
19	*		*	4.4v	*BLIS	*BLISS		U5(19)
20	*		*	3.5v	*BLIT	*BLIT		U5(15)
21	*		*	3.8v	*WE	*WE		U35(17)
22	*		*	4.5v	R/W	READ/WRITE		U1(9),U5(12),
								EXP.P1(68),RP101(7)
23	*		*	5.1v	*RGEN	*REGEN		U5(18)
24	*	*	*	1.6v	*AS	*ADD.STROBE		U1(6),U5(13),
								EXP.P1(74),RP101(8)
25	*	*	*	3.1v		*RAMEN		U5(20)
26	*		*	3.8v	RGA8			U3(19),U4(10)
27	*		*	3.5v	RGA7			U3(20),U4(11)
28	*		*	3.4v	RGA6			U3(21),U4(12)
29	*		*	3.5v	RGA5			U3(22),U4(13)
30	*		*	3.8v	RGA4			U3(23),U4(14)
31	*		*	3.4v	RGA3			U3(24),U4(15)
32	*		*	3.4v	RGA2			U3(25),U4(16)
33	*		*	3.5v	RGA1			U3(26),U4(17)
34	*	*	*	1.4v	28mhz	28 MHZ		FB101-X1(8)
35		*		136m	XCLK			RP103-U33(12)RP104(2
36	*			5.2v		*XCLKEN		EXTERNAL CLK ENABLE
37	*		*	1.6v	*COAC			U5(26),U33(11)
								R106(2),U4(34)
38	*	*	*	1.6v	7mhz	7 MHZ		U1(15),R103(2),
								RP103-U4(35)
39	*		*	1.7v	CCKQ			U5(27),U33(5),R107(2
								U3(29)
40	*		*	1.7v	CCK			U5(28),U33(3),R108(2
								U3(28),U4(36)
41		*		.7mV		TEST		GROUNDED
42		*		0v	GND	GROUND		
43	*		*	3.1v	ORA0			U34(4)
44	*		*	3.2v	ORA1			U34(8)
45	*		*	3.5v	ORA2			U34(6)
46	*		*	3.4v	ORA3			U34(17)
47	*		*	3.2v	ORA4			U34(15)
48	*		*	3.1v	ORA5			U34(13)
49	*		*	3.3v	ORA6			U34(2)
50	*		*	2.9v	ORA7			U34(11)
51	*		*	2.8v	ORA8			U35(1)
52	*	*	*	1.9v	*LOS	LO.O.STROBE		U1(8),U5(10),
								EXP.P1(70),RP101(5)
53	*		*	1.9v	*UOS	UP.O.STROBE		U1(7),U5(11),
								EXP.P1(72),RP101(6)
54	*		*	3.2v	*CASL			U35(8)
55	*		*	3.2v	*CASU			U35(13)
56	*		*	4.2v	*RAS1			U35(2)
57	*		*	3.1v	*RAS0			U35(15)
58		*		0v	GND	GROUND		
59	*		*	2.6v	A19	ADD.LINE		SEE ADDRESS CHART

U2 8370/8371 EAT AGNUS —(CONTINUED)

PIN No.	L/PROBE H	L	P	VOLTS MET.	LABEL	DETAILS	SIG TYP	CONNECTIONS
60	*		*	2.1v	A1	ADD.LINE		SEE ADDRESS CHART
61	*	*	*	2.4v	A2	"		"
62	*	*	*	2.3v	A3	"		"
63	*		*	2.3v	A4	"		"
64	*		*	2.1v	A5	"		"
65	*		*	1.7v	A6	"		"
66	*		*	3.3v	A7	"		"
67	*		*	1.8v	A8	"		"
68	*	*	*	2.0v	A9	"		"
69	*	*	*	1.5v	A10	"		"
70	*	*	*	2.9v	A11	"		"
71	*	*	*	2.5v	A12	"		"
72	*	*	*	0.9v	A13	"		"
73		*	*	240m	A14	"		"
74	*	*	*	2.1v	A15	"		"
75		*	*	53mV	A16	"		"
76	*	*	*	2.1v	A17	"		"
77	*	*	*	2.7v	A18	"		"
78	*	*	*	5.3v	*LP	(*FIRE 1)		CN2(6),U7(9)
79	*			5.1v	*VSY	*VSYNC		RP403-CN9(12) VIDEO U7(19)
80	*		*	3.7v	*CSY	*CSYNC		U4(32),U41(8&9)
81	*		*	4.8v	*HSY	*HSYNC		R402(2),R403-CN9(11) U8(19)
82		*		0v	GND	GROUND		
83	*	*	*	1.5v	DRD15			U12(3),U13(18), CNX(20),U31(2),U3(42) U4(40)
84	*	*	*	1.2v	DRD14			U12(5),U13(17), CNX(19),U30(2),U3(43) U4(41)

NOTE

Pin numbers that have an asterisk with their label name are signals that are switched on and are active when the signal is in a " low " state.

Pin numbers without an asterisk to their label name are signals that are active in a " high " state.

I.C.	I.C.TYPE	DESCRIPTION
U4	8362	DENISE

PIN No.	L/PROBE H	L	P	VOLT MET.	LABEL	DETAILS	SIG TYP	CONNECTIONS
1	*	*	*	1.6v	D6	DATA LINE		SEE DATA LINE CHART
2	*	*	*	2.0v	D5	"		"
3	*	*	*	1.3v	D4	"		"
4	*	*	*	2.0v	D3	"		"
5	*	*	*	1.8v	D2	"		"
6	*	*	*	1.6v	D1	"		"
7	*	*	*	1.3v	D0	"		"
8				1.9v	M1H			RP405(5),
								RP404-U15(12)
9				1.8v	M0H			RP405(3),
								RP404-U15(7)
10	*		*	3.8v	RGA8			U2(26),U3(19),
11	*		*	3.5v	RGA7			U2(27),U3(20)
12	*		*	3.4v	RGA6			U2(28),U3(21)
13	*		*	3.5v	RGA5			U2(29),U3(22)
14	*		*	3.8v	RGA4			U2(30),U3(23)
15	*		*	3.4v	RGA3			U2(31),U3(24)
16	*		*	3.4v	RGA2			U2(32),U3(25)
17	*		*	3.5v	RGA1			U2(33),U3(26)
18	*		*	5.0v	BST	BURST		NOT CONNECTED
19	*			5.2v	Vcc	+5 volts		+5 VOLTS D.C.
20	*	*	*	3.0v	R0			U40(5)
21	*	*	*	3.0v	R1			U40(4)
22	*	*	*	3.0v	R2			U40(3)
23	*	*	*	2.9v	R3			U40(2)
24	*	*	*	2.9v	B0			U41(5)
25	*	*	*	2.9v	B1			U41(4)
26	*	*	*	3.0v	B2			U41(3)
27	*	*	*	3.0v	B3			U41(2)
29	*	*	*	3.0v	G0			U40(9)
29	*	*	*	3.0v	G1			U40(8)
30	*	*	*	3.0v	G2			U40(7)
31	*	*	*	2.9v	G3			U40(6)
32	*		*	3.7v		BLANK		U41(8&9),U2(80)
33	*	*	*	2.7v	ZD	PIXELSW		U41(7)
34	*	*	*	1.6v	*COAC	*COAC		U2(37),U5(26),
								U33(11),R106(2)
35	*	*	*	1.6v	CKK	7 MHZ		U1(15),R103(2),
								U2(38)
36	*	*	*	1.7v	CCK			U2(40),U3(29),R108(2
								U5(28),U33(3)
37		*		0v	GND	GROUND		
38				1.9v	M0V			RP405(2),
								RP404-U15(4)
39				1.8v	M1V			RP405(4),
								RP404-U15(9)
40	*	*	*	1.5v	D15	DATA LINE		SEE DATA LINE CHART
41	*	*	*	1.2v	D14	"		"

U4	8362	DENISE	(CONTINUED)

PIN No.	L/PROBE H	L	P	VOLT MET.	LABEL	DETAILS	SIG TYP	CONNECTIONS
42	*	*	*	1.2v	D13	DATA LINE		SEE DATA LINE CHART
43	*	*	*	1.1v	D12	"		"
44	*	*	*	1.4v	D11	"		"
45	*	*	*	1.3v	D10	"		"
46	*	*	*	1.5v	D9	"		"
47	*	*	*	1.3v	D8	"		"
48	*	*	*	1.9v	D7	"		"

NOTES

Pin numbers that have an asterisk with their label name are signals that are switched on and are active when the signal is in a " low " state.

Pin numbers without an asterisk to their label name are signals that are active in a " high " state.

Signals R0 to R3, G0 to G3 and B0 to B3 are connected to U40 and U41 respectively and are part of the color and video functions.

Signals M1H,M0H and M0V,M1V are connected to U15 and are part of the Joystick Port functions.

I.C.	I.C.TYPE	DESCRIPTION
U5	5719	GARY

PIN No.	L/PROBE H	L	P	VOLT MET.	LABEL	DETAILS	SIG TYP	CONNECTIONS
1		*		0v	GND1	GROUND		
2	*		*	5.2v	*VPA			R102-U1(21),R101(2),
								EXP.P1(50)
3	*		*	4.8v	*DEL			U11(1),U13(1)
4	*		*	4.8v	*DES			U10(1&19),U12(1&19)
5	*			5.2v		*KBRESET		Q711(3),RP501(5)
6	*			5.2v	Vcc1	+5 volts		+5 VOLTS O.C.
7	*			5.2v	*MTR			U8(17)
8		*		158m	DKWE			U3(39)
9	*			4.1v	*DKWD			U3(38)
10	*	*	*	2.0v	*LDS	LO.D.STROBE		U1(8).U2(52),
								RP101(5),EXP.P1(70)
11	*	*	*	1.9v	*UDS	UP.D.STROBE		U1(7),U2(53),
								RP101(6),EXP.P1(72)
12	*		*	4.5v	R/W	READ/WRITE		U1(9),U2(22),
								RP101(7),EXP.P1(68)
								U7(22),U8(22)
13	*	*	*	1.7v	*AS	ADD.STROBE		U1(6),U2(24),
								RP101(8),EXP.P1(74)
14	*			5.2v		*BGACK		U1(12),RP104(4)
								EXP.P1(62)
15	*		*	3.5v	*BLIT			U2(20)
16	*		*	5.2v	*SELO			U8(13)
17	*			5.2v	Vcc2	+5 volts		+5 VOLTS O.C.
18	*		*	5.2v		*REGEN		U2(23)
19	*		*	4.4v		*BLISS		U2(19)
20	*	*	*	3.1v		*RAMEN		U2(25)
21	*	*	*	3.4v		*ROMEN		U6(12)
22	*			5.2v		*CLKRD		CNX(49)
23	*			5.2v		*CLKWR		CNX(50)
24		*		0v	GND2	GROUND		
25	*	*	*	2.5v		*LATCH		U11(11),U13(11)
26	*	*	*	1.6v		*CDAC		U2(37),U4(34),
								U33(11),R106(2)
27	*	*	*	1.7v	CCKQ			U2(39),U3(29),
								U33(5),R107(2)
29	*	*	*	1.7v	CCK			U2(40),U3(28),U4(36)
								U33(3),R108(2)
29	*			5.2v	*OVR			RP104(7),EXP.P1(17)
30		*		16mV	OVL			U7(2)
31	*			5.2v	XRDY			RP104(6),EXP.P1(18)
32	*			5.2v		*EXRAM		CNX(32)
33	*	*	*	2.0v	A17	ADD.LINE		SEE ADDRESS CHART
34	*	*	*	2.6v	A18	"		"
35	*	*	*	2.6v	A19	"		"
36	*	*	*	2.7v	A20	"		"
37	*	*	*	2.5v	A21	"		"
38	*	*	*	2.6v	A22	"		"

U5 - 5719 GARY (CONTINUED)

PIN No.	L/PROBE H	L	P	VOLT MET.	LABEL	DETAILS	SIG TYP	CONNECTIONS
39	*	*	*	2.6v	A23	ADD.LINE		SEE ADDRESS CHART
40		*		0v	GND3	GROUND		
41	*			5.2v	*RST	*RESET		U1(18),U2(16),U3(11)
								RP104(4),EXP.P1(53)
42	*			5.2v	*HLT	*HALT		U1(17),RP101(9),
								EXP.P1(55)
43	*	*	*	2.9v		*DTACK		R101-U1(10),
								RP104(2),EXP.P1(66)
44		*		3mV		DKWEB		U36(13)
45		*		3mV		DKWDB		U36(10)
46		*		6mV		MTRON		U36(5)
47		*		3mV		MTRX		U36(2)
48	*			5.2v	Vcc3	+5 volts		+ 5 VOLTS D.C.

NOTES

Pin numbers that have an asterisk with their label name are signals that are switched on and are active when the signal is in a " low " state.

Pin numbers without an asterisk to their label name are signals that are active in a " high " state.

Control Signals associated with U5 GARY are on pins :

2,3,4,10,11,12,13,14,15,18,19,20,21,22,23,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,41,42 & 43

Floppy Functions associated with U5 GARY are on pins :

5,7,8,9,16,44,45,46 & 47

+5 Volts is supplied to the chip on pins :

6,17 & 48

The following pins are connected to Ground :

1,24 & 40

I.C.	I.C. TYPE	DESCRIPTION
U6	315093	KICKSTART ROM

PIN No.	L/PROBE H	L	P	VOLT MET.	LABEL	DETAILS	SIG TYP	CONNECTIONS
1								
2	*	*	*	1.8v	A7	ADD.LINE		SEE ADDRESS CHART
3	*	*	*	3.3v	A6	"		"
4	*	*	*	1.6v	A5	"		"
5	*	*	*	2.1v	A4	"		"
6	*	*	*	2.3v	A3	"		"
7	*	*	*	2.3v	A2	"		"
8	*	*	*	2.4v	A1	"		"
9	*	*	*	2.1v	A0	"		"
10		*		0v	GND	GROUND		
11		*		0v				
12	*	*	*	3.4v	OE	*ROMEN		U5(21)
13	*	*	*	1.5v	D0	DATA LINE		SEE DATA LINE CHART
14	*	*	*	1.0v	D8	"		"
15	*	*	*	1.7v	D1	"		"
16	*	*	*	1.7v	D9	"		"
17	*	*	*	2.1v	D2	"		"
18	*	*	*	1.5v	D10	"		"
19	*	*	*	2.7v	D3	"		"
20	*	*	*	1.4v	D11	"		"
21	*			5.2v	Vcc	+5 volts		+5 VOLTS D.C.
22	*	*	*	1.9v	D4	DATA LINE		SEE DATA LINE CHART
23	*	*	*	0.7v	D12	"		"
24	*	*	*	2.2v	D5	"		"
25	*	*	*	1.4v	D13	"		"
26	*	*	*	1.8v	D6	"		"
27	*	*	*	1.4v	D14	"		"
28	*	*	*	1.4v	D7	"		"
29	*	*	*	0.6v	D15	"		"
30		*		0v				
31	*	*	*	2.6v	A17	ADD. LINE		SEE ADDRESS CHART
32	*	*	*	2.0v	A16	"		"
33		*	*	49mV	A15	"		"
34	*	*	*	2.0v	A14	"		"
35	*	*	*	240m	A13	"		"
36	*	*	*	0.9v	A12	"		"
37	*	*	*	2.5v	A11	"		"
38	*	*	*	2.9v	A10	"		"
39	*	*	*	1.5v	A9	"		"
40	*	*	*	2.0v	A8	"		"

I.C.	I.C.TYPE	DESCRIPTION
U7	8520	COMPLEX INTERFACE ADAPTER (CIA) [000]

PIN No.	L/PROBE H	L	P	VOLT MET.	LABEL	DETAILS	SIG TYP	CONNECTIONS
1		*		0v				
2		*		16mV	PA0	OVL		U5(30)
3		*		82mV	PA1	*LED		R503-Q502(2),R505(2)
								U38(2)
4	*			5.1v	PA2	*CHNG		CN11(2),CN5(11)
5	*			5.1v	PA3	*WPROT		CN11(28),CN5(14)
6	*			5.1v	PA4	*TRK0		CN11(26),CN5(15)
7	*			5.1v	PA5	*RDY		CN11(34),CN5(1)
8	*			5.1v	PA6	*FIRE0		CN1(6),C411(1)
9	*			5.1v	PA7	*FIRE1		CN2(6),C421(1),U2(78
10	*			5.1v	PB0	PPD0		CN7(2)
11	*			5.1v	PB1	PPD1		CN7(3)
12	*			5.1v	PB2	PPD2		CN7(4)
13	*			5.1v	PB3	PPD3		CN7(5)
14	*			5.1v	PB4	PPD4		CN7(6)
15	*			5.1v	PB5	PPD5		CN7(7)
16	*			5.1v	PB6	PPD6		CN7(8)
17	*			5.1v	PB7	PPD7		CN7(9)
18	*			5.2v	*PC	*STROBE		RP501(10),CN7(1)
19	*			5.1v	TICK	*VSYNC		U2(79),RP403-CN9(12)
20	*			5.2v	Vcc	+5 volts		+5 VOLTS O.C.
21	*			5.2v	*INT	*INT2		RP501(9),U3(16),
								EXP.P1(19)
22	*		*	4.5v	*W	R *W		U8(22),U1(9),U5(12)
								RP101(7),EXP.P1(68)
23	*		*	4.3v	*CS			U37(3)
24	*			5.1v	*F	*ACK		RP501(6),CN7(10)
25	*	*	*	2.0v	E			U8(25),U1(20),
								EXP.P1(50)
26	*	*	*	1.4v	D7	DATA LINE		SEE DATA LINE CHART
27	*	*	*	1.8v	D6	"		"
28	*	*	*	2.2v	D5	"		"
29	*	*	*	1.9v	D4	"		"
30	*	*	*	2.7v	D3	"		"
31	*	*	*	2.0v	D2	"		"
32	*	*	*	1.7v	D1	"		"
33	*	*	*	1.5v	D0	"		"
34	*			4.4v		*RESET		U8(34),U37(11)
35	*	*	*	2.9v	RS3	A11		SEE ADDRESS CHART
36	*	*	*	1.5v	RS2	A10		"
37	*	*	*	2.0v	RS1	A9		"
38	*	*	*	1.8v	RS0	A8		"
39	*			5.1v	S	*KBCLOCK		RP501(3),CN13(2)
40	*			5.1v	C	*KBDATA		RP501(2),CN13(1)

CN1 : LEFT J/STICK PORT
CN2 : RIGHT J/STICK PORT
CN5 : EXTERNAL FLOPPY PORT
CN7 : CENTRONICS PORT
CN9 : VIDEO PORT
CN11: INTERNAL FLOPPY PORT
CN13: KEYBOARD PORT

I.C.	I.C.TYPE	DESCRIPTION
U8	8520	COMPLEX INTERFACE ADAPTER (CIA) [EVEN]

PIN No.	L/PROBE H	L	P	VOLT MET.	LABEL	DETAILS	SIG TYP	CONNECTIONS
1		*		0v				
2	*			5.1v	PA0	BUSY		U8(39),CN7(11)
3	*			5.1v	PA1	POOT		U8(40),CN7(12)
4	*			5.1v	PA2	SEL		RP501(4),Q501(3),
								CN7(13)
5	*			5.1v	PA3			U39(8)
6	*			5.1v	PA4			U39(6)
7	*			5.1v	PA5			U39(11)
8	*			5.1v	PA6			U38(4)
9	*			5.1v	PA7			U38(12)
10	*			5.1v	PB0	*STEP		CN5(18),CN11(20)
11	*			5.1v	PB1	DIR		CN5(19),CN11(18)
12	*			5.1v	PB2	*SIDE		CN5(13),CN11(32)
13	*			5.1v	PB3	*SEL0		CN11(10)
14	*			5.1v	PB4	*SEL1		CN5(21),CN11(12)
15	*			5.1v	PB5	*SEL2		CN5(9),
16	*			5.1v	PB6	*SEL3		CN5(20),
17	*			5.1v	PB7	*MTR		
18								NOT CONNECTED
19	*		*	4.8v	TICK	*HSYNC		U2(81),R402(2),
								R403-CN9(11)
20	*			5.2v	Vcc	+5 volts		+5 VOLTS O.C.
21	*			5.2v	*INT	*INT6		U3(18),RP501(8),
								EXP.P1(22)
22	*		*	4.5v	*W	R *W		U7(22),U1(9),U5(12),
								RP101(7),EXP.P1(68)
23	*		*	4.3v	*CS			U37(6)
24	*			5.1v	*F	*INDEX		RP501(7),CN5(22),
								CN11(8)
25	*	*	*	2.0v	E			U7(25),U1(20),
								EXP.P1(50)
26	*	*	*	1.4v	D7	DATA LINE		SEE DATA LINE CHART
27	*	*	*	1.4v	D6	"		"
28	*	*	*	1.4v	D5	"		"
29	*	*	*	0.7v	D4	"		"
30	*	*	*	1.4v	D3	"		"
31	*	*	*	1.5v	D2	"		"
32	*	*	*	1.7v	D1	"		"
33	*	*	*	1.0v	D0	"		"
34	*			4.3v	*RST	*RESET		U7(34),U37(11)
35	*	*	*	2.9v	RS3	A11		SEE ADDRESS CHART
36	*	*	*	1.5v	RS2	A10		"
37	*	*	*	2.0v	RS1	A9		"
38	*	*	*	1.8v	RS0	A8		"
39	*			5.1v		BUSY		U8(2),CN7(11)
40	*			5.1v		POUT		U8(3),CN7(12)

CN5 : EXTERNAL FLOPPY PORT CN7 : CENTRONICS PORT
CN9 : VIDEO PORT CN11: INTERNAL FLOPPY PORT
PINS:5,6,7,8 & 9 are associated with the RS232 SERIAL PORT

I.C.	I.C.TYPE	DESCRIPTION
U3	8364-	PAULA

PIN No.	L/PROBE H	L	P	VOLT MET.	LABEL	DETAILS	SIG TYP	CONNECTIONS
1	*	*	*	1.3v	D7	DATA LINE		SEE DATA LINE CHART
2	*	*	*	1.3v	D7	"		"
3	*	*	*	1.6v	D6	"		"
4	*	*	*	2.0v	D5	"		"
5	*	*	*	2.1v	D4	"		"
6	*	*	*	2.0v	D3	"		"
7	*	*	*	1.8v	D2	"		"
8		*		0v	GND	GROUND		
9	*	*	*	1.6v	D1	DATA LINE		SEE DATA LINE CHART
10	*	*	*	1.3v	D0	"		"
11	*			5.2v	*RES	*RESET		U1(18),U3(11),U5(41)
								RP104(4),U2(16)
12		*	*	102m	DMAL			U2(18)
13	*		*	5.1v	*IPL0			U1(25),RP102(7),
								EXP.P1(40)
14	*		*	5.1v	*IPL1			U1(24),RP102(8),
								EXP.P1(42)
15	*			5.2v	*IPL2			U1(23),RP102(9),
								EXP.P1(44)
16	*			5.2v	*INT2			RP501(9),U7(21)
								EXP.P1(19)
17	*			4.1v	*INT3			U2(17)
18	*			5.2v	*INT6			RP501(8),U8(21),
								EXP.P1(22)
19	*		*	3.8v	RGA8			U2(26),U4(10)
20	*		*	3.5v	RGA7			U2(27),U4(11)
21	*		*	3.4v	RGA6			U2(28),U4(12)
22	*		*	3.5v	RGA5			U2(29),U4(13)
23	*		*	3.8v	RGA4			U2(30),U4(14)
24	*		*	3.4v	RGA3			U2(31),U4(15)
25	*		*	3.4v	RGA2			U2(32),U4(16)
26	*		*	3.5v	RGA1			U2(33),U4(17)
27	*			5.0v	Vcc	+5 volts		+5 VOLTS D.C.
28	*	*	*	1.7v	CCK			U2(40),U4(36),U5(29)
								U33(3),R108(2)
29	*	*	*	1.7v	CCKQ			U2(39),U5(27),U33(5)
								R107(2)
30				2.5v	AUD 8	RIGHT		R339(2),U14(9),
								R331(1),C331(1)
31				2.5v	AUD A	LEFT		U14(13),R321(1)
								C321(1)
32	*			4.1v	POX	POTOX		C311(2),C413(1),
								CN1(5)
33	*			4.1v	POY	POTOY		C312(2),C412(1),
								CN1(9)
34		*		0v	GND	GROUND		
35					P1X	POT1X		C313(2),C423(1),
								CN2(5)

U3	8364	PAULA	(CONTINUED)

PIN No.	L/PROBE H	L	P	VOLT MET.	LABEL	DETAILS	SIG TYP	CONNECTIONS
36					POT1Y	POT1Y		C314(2),C422(1),
								CN2(9)
37	*			5.2v	*DKRD			R305(1),CN5(2)
38	*			4.1v	*DKWD			U5(9)
39		*		158m	DKWE			U5(8)
40	*			4.1v	*TXD			U38(9)
41	*			5.2v	*RXD			U39(3)
42	*	*	*	1.5v	D15	DATA LINE		SEE DATA LINE CHART
43	*	*	*	1.2v	D14	"		"
44	*	*	*	1.2v	D13	"		"
45	*	*	*	1.2v	D12	"		"
46	*	*	*	1.4v	D11	"		"
47	*	*	*	1.3v	D10	"		"
48	*	*	*	1.5v	D9	"		"

NOTES

Pin numbers that have an asterisk with their label name are signals that are switched on and are active when the signal is in a " low " state.

Pin numbers without an asterisk to their label name are signals that are active in a " high " state.

Signals POTOX,POTOY, are inputs to the LEFT Joystick Control Port (CN1).

Signals POT1X,POT1Y, are inputs to the RIGHT Joystick Control Port (CN2)

Signals *DKWD,DKWE, are connected to U5 GARY and are part of the Floppy Functions.

Signal *DKRD is connected to the External Floppy Port (CN5)

Signals *TXD,*RXD, are connected to U38 and U39 respectively and are part of the RS232 Functions.

Signals AUD B (RIGHT),AUD A (LEFT) are connected to U14 and are part of the Audio Out Functions.

U10 : 74LS244 : NON - INVERTING BUFFER/LINE DRIVER/RECEIVER

PINS

2,18 : D0	4,16 : D1	6,14 : D2	8,12 : D3
11,9 : D4	13,7 : D5	15,5 : D6	17,3 : D7
1,19 : *DEB,U5(4)	10 : GND	20 : +5v	

U11 : 74LS373 : D - TYPE LATCH

PINS

2,3 : D0	4,5 : D1	6,7 : D2	8,9 : D3
12,13 : D4	14,15 : D5	16,17 : D6	18,19 : D7
1 : *DEL,U5(3)	11 : *LATCH,U5(25)		
10 : GND	20 : +5v		

U12 : 74LS244 : NON - INV.BUFFER/LINE DRIVER/RECEIVER

PINS

2,18 : D8	4,16 : D9	6,14 : D10	8,12 : D11
9,11 : D12	7,13 : D13	5,15 : D14	3,17 : D15
1,19 : *DEB,U5(4)		10 : GND	20 : +5v

U13 : 74LS373 : D - TYPE LATCH

PINS

2,3 : D8	4,5 : D9	6,7 : D10	8,9 : D11
12,13 : D12	14,15 : D13	16,17 : D14	18,18 : D15
1 : *DEL,U5(3)		11 : *LATCH,U5(25)	
10 : GND	20 : +5v		

U14 : LF347/TL084

IN AUDIO OUT (LEFT & RIGHT) FILTER CIRCUITS

U15 : 74LS157 : LINE DATA SELECTOR

IN JOYSTICK LEFT (CN1) & RIGHT (CN2) CONTROL CIRCUIT

U16 - U32 : 256K DYNAMIC RANDOM ACCESS MEMORY (RAM)

PINS

5 : A0	7 : A1	6 : A2	12 : A3	11 : A4	10 : A5
13 : A6	9 : A7	1 : A8			
3 : *WE,U35(3)	4 : *RAS,U35(5)			15 : *CAS,U35(12)	
2,14 : DATA LINES (SEE BELOW)					

D0:U16 D1:U17 D2:D18 D3:D19 D4:D20 D5:U21 D6:U22
D7:U23 D8:D24 D9:U25 D10:U25 D11:D27 D12:U28 D13:U29
D14:U30 D15:U31

U32 : 74F74 : D-TYPE BISTABLE (FAST)

U33 : 74F04 : HEX INVERTER (FAST)

USED IN CLOCK CIRCUIT INTEREACING

U34 : NON - INV.BUFFER/LINE DRIVER/RECEIVER (FAST) 74F244

USED IN DATA LINE INTERFACING TO RAM I.C's.

PINS

4,16:D0 8,12:D1 6,14:D2 3,17:D3 5,15:D4 7,13:D5 2,18:D6
9,11:D7 1,19:GND,20 : +5v

U35 : NON INV.BUFFER/LINE DRIVER/RECEIVER (FAST) 74F244

USED IN ONE DATA LINE INTERFACE TO RAM I.C.'s (D8) AND THE COLUMN AND ROW ADDRESS STROBES TO RAM I.C.'s AND READ/WRITE TO THE RAMS.

PINS

1,9:D8 8,12:*CASL,U2(54) 7,13:*CASU,U2(55)
5,15:*RASO,U2(57) 2,18:*RAS1,U2(56) 3,17:*WE,U2(21)
1,19:GND 4,6:GND 20 :+5v

U36 : 74LS38 : NAND BUFFER

INTERFACING TO INTERNAL AND EXTERNAL FLOPPY DRIVES (CONTROL)

SEE D5 GARY CHART

U37 : 74LS32 : 2 - INPUT OR GATE

USED IN CHIP SELECT CONTROL ON U7 & U8 8520 CIA's (PIN 23)

ALSO IN RESET ACTION CIRCUIT *RST to *IORESET,CN5(10)CN7(16)
AND *RESET,U7 & U8(34)

U38 : 1488 LINE DRIVER

USED IN RS232 SERIAL PORT CIRCUIT

U39 : 1489 RECEIVER

USED IN RS232 SERIAL PORT CIRCUIT

U40 & 41 : NON - INV.BUS TRANSCEIVER

USED IN VIDEO CIRCUIT, U4 DENISE to U40 & U41 to HY1 VIDEO HYBRID CHIP and CN9 VIDEO PORT

U42 : NE555
USED IN RESET ACTION CIRCUIT.GENERATES *KBRESET SIGNAL

DATA LINE CHART

	U1	U3	U4	U6	U7	U8	U10	U11	U12	U13	U34
D0	5	10	7	13	33	33	2&18	2&3			4&16
D1	4	9	6	15	32	32	4&16	4&5			8&12
D2	3	7	5	17	31	31	6&14	6&7			6&14
D3	2	6	4	19	30	30	8&12	8&9			3&17
D4	1	5	3	22	29	29	9&11	12&13			5&15
D5	64	4	2	24	28	28	7&13	14&15			7&13
D6	63	3	1	26	27	27	5&15	16&17			2&18
D7	62	2	48	28	26	26	3&17	18&19			9&11
D8	61	1	47	14					2&18	2&3	
D9	60	48	46	16					4&16	4&5	
D10	59	47	45	18					6&14	6&7	
D11	58	46	44	20					8&12	8&9	
D12	57	45	43	23					9&11	12&13	
D13	56	44	42	25					7&13	14&15	
D14	55	43	41	27					5&15	16&17	
D15	54	42	40	29					3&17	18&19	

ALSO D8 : U35 (1&9).

SEE U16 - U32 CHART FOR DRAM DATA CONNECTIONS

NOTE

NUMBER IN MATRIX REFERS TO PIN NUMBER ON THE I.C.

ADDRESS LINE CHART

	U1	U2	U5	U6	U7	U8	DRAMS(U16 - U32)
A0				9			5
A1	29	60		8			7
A2	30	61		7			6
A3	31	62		6			12
A4	32	63		5			11
A5	33	64		4			10
A6	34	65		3			13
A7	35	66		2			9
A8	36	67		40	38	38	1
A9	37	68		39	37	37	
A10	38	69		38	36	36	
A11	39	70		37	35	35	
A12	40	71		36			
A13	41	72		35			
A14	42	73		34			
A15	43	74		33			
A16	44	75		32			
A17	45	76	33	31			
A18	46	77	34				
A19	47	59	35				
A20	48		36				
A21	50		37				
A22	51		38				
A23	52		39				

NOTE

NUMBERS IN MATRIX REFER TO PIN NUMBER ON THE I.C.